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ABSTRACT

The Total Energy Management (TEM) for Minnesota Schools program is a unified, planned approach to reducing the energy use and costs of an individual school or school district. The program is designed to increase energy awareness and improve school energy efficiency through: (1) careful energy accounting; (2) changes in operations and maintenance procedures; (3) modifications in the building envelope and its energy using systems; (4) transportation management; and (5) development of curricula with an energy focus. During the first year of the program, school districts were encouraged to enter their programs in a TEM competition. Winners, selected according to three criteria (involvement in energy management, energy-related educational activities, and improvement in energy systems and operations) included school districts with comprehensive programs and accomplishments in each area as well as districts which had only started TEM programs. This booklet describes the efforts of these school districts and serves as a forum of ideas about energy management programs for other school districts throughout the state. These descriptions are provided within the framework of a model TEM program. The model consists of four phases (initiation, development, implementation, and evaluation) which any school can follow or adapt to develop its energy saving potential. (JN)

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Total Energy Management: Award Winning Projects of Minnesota Schools

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Foreword

The Total Energy Management for Minnesota Schools program is a unified, planned approach to reducing the energy use and costs of an individual school or a school district.

The program is designed to increase energy awareness and improve school energy efficiency through careful energy accounting, changes in operations and maintenance procedures, modifications in the building envelope and its energy using systems, transportation management, and curriculum with an energy focus.

During the first year of the Total Energy Management program, school districts in Minnesota were encouraged to enter their programs in a Total Energy Management competition. This booklet recognizes the efforts of the winning school districts and serves as a forum of ideas about energy management programs for other school districts throughout the state.

Winners were selected according to the following criteria:

- ☐ Involvement in energy management
- ☐ Energy-related educational activities
- ☐ Improvements in energy systems and operations

Several winning school districts had comprehensive programs with accomplishments in each area, but other winning districts had only started Total Energy Management programs.

Each winning district received a cash award donated by Northern States Power for energy-related activities and a certificate signed by Governor Perpich. Public recognition was provided at regional award ceremonies and through newspaper, radio and TV coverage.

In 1984 a second Total Energy Management competition will be held for public and non-public schools in Minnesota.

Details about the competition are available from the Energy Division of the Minnesota Department of Energy and Economic Development.

The following pages give a composite view of a model Total Energy Management program for Minnesota schools. Examples cited are actual results provided by winning school districts in the 1983 competition.

1983 TEM Winners

Alexandria Independent School District
Anoka Independent School District
Appleton Independent School District
Bagley Independent School District
Brooten Independent School District
Dover Eyota Independent School District
Duluth Independent School District
East Grand Forks Independent School District
Elk River Independent School District
Gonvick Trail Independent School District
Hallock Independent School District
Hopkins Independent School District
Luverne Independent School District
Mankato Independent School District
McGregor Independent School District
Montevideo Independent School District
Monticello Independent School District
New York Mills Independent School District
Ortonville Independent School District
Pillager Independent School District
Roseville Independent School District
Royalton Independent School District
St. Charles Independent School District
St. Martins Lutheran School
St. Paul Independent School District
Staples Independent School District
Swanville Independent School District
Upsala Independent School District

Awards

Total Energy Management: A Model Process

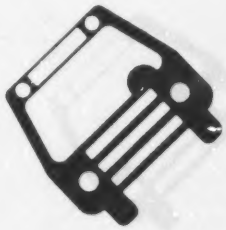
Schools can reach their energy saving potential through careful energy management encompassing all aspects of school operation. The goal of a Total Energy Management approach is to reduce school energy use. To meet this goal, energy management has three main objectives:

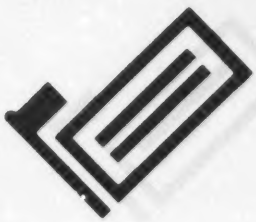
- ☐ To develop an energy consciousness among school staff and students,
- ☐ To ensure that energy implications are a high priority in school decision making, and
- ☐ To operate each school at its peak energy efficiency.

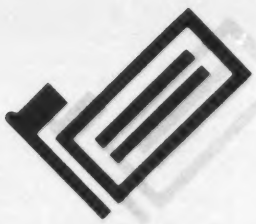
Schools can implement Total Energy Management programs to reach their energy saving potential in several ways. Each school or district can develop a process tailored to fit its own needs. The organizational structure for an overall energy education and management program can range from simple, with one staff person responsible for all aspects of the program, to complex, with several committees directing the various components of the program.

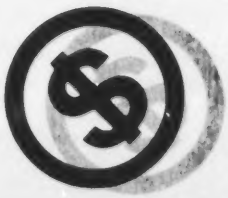
Whatever structure a school chooses for carrying out Total Energy Management, the program will be effective only with the on going commitment of those who use and maintain the school building and vehicles. Active support by the district's leadership is also essential. A team approach is a good model for the coordination of energy education and management activities.

Every school and district is unique, but some common elements and basic procedures go into a successful education and management program. The four phases of a Total Energy Management program are: 1) Initiation; 2) Development; 3) Implementation; and 4) Evalu-









ation. The following steps outline the process any school can follow or adapt to develop their energy saving potential.

Initiation

Obtain School Board and Top Administrative Commitment. For the program to be effective, the school board should support Total Energy Management through a formal board resolution. Once the energy program is supported by the school board and top level administration, site level administrators will support the energy program as well. These layers of support are necessary because energy use is a factor in many administrative decisions.

Designate an Energy Coordinator. One person should be given authority to spearhead and implement the Total Energy Management program. The energy coordinator should be committed to energy management and capable of organizing and leading a working team. To effectively implement plans, the coordinator

School Board Policy Statement
East Grand Forks School District

School Board Resolution
The Board of Education recognizes that reducing energy costs can be an effective means of maintaining quality educational services as well as an educational opportunity in and of itself. Therefore, it shall be the policy of the Board of Education to adopt a Total Energy Management program in order to control energy costs and to increase energy awareness among students, teachers, administrators, staff and the community at large.

It shall be the responsibility of each district employee and student to participate actively in conservation efforts in order to reduce consumption and increase efficiency. However, every effort shall be made to maintain programs for the benefit of students.
It shall be the responsibility of the district administrators to plan, implement, direct, monitor, evaluate and report district energy conservation efforts.

Energy Coordinator
Mankato School District The Director of Business Affairs serves as the energy coordinator in the Mankato School District. The energy coordinator's functions are clearly defined:

Energy Coordinator Functions
1. Responsible for the coordination of entire district energy conservation program.
2. Responsible for energy accounting and reporting.
3. Responsible for energy building improvement plans.
4. Provides in-service training for custodial/maintenance/food service staff.
5. Responsible for staff and student energy awareness program.
6. Responsible for implementation of energy efficient operation and maintenance practices.
7. Responsible for working with Citizens' Energy Advisory Committee and implementation of their recommendations.
8. Responsible for working with community groups concerned with energy conservation.

Through an effective energy management program, the Mankato School District has saved more than $200,000 in energy bills since the 1976-77 school year.

must receive support from the administration.

Establish an Energy Team.

An energy team should involve several people at the school and in the district. Participation develops commitment. The more people involved in a meaningful way, the more commitment there will be for the Total Energy Management program.

The energy team should represent the range of people who affect and are affected by school energy use, including administrators, board members, teachers, building engineers, custodians, students, food service and transportation personnel and parents.

The role of the energy team is to:

☐ discuss policies and actions that are working and are not working,

☐ develop and carry out an energy plan with specific strategies,

☐ prioritize expenditures for energy saving projects,

☐ facilitate communications between the individual schools, top level administrators and the school board on energy goals and policy,

☐ review monthly energy consumption data and adapt plans accordingly, and

☐ communicate energy use data to each school

Assess District's Energy Status.

Review school energy records, any previously done audits, existing energy education programs, and past and current conservation efforts.

Chart how much energy the district is using currently and compare it to the use in previous years. By designating a specific year's energy use as a baseline, it is possible to determine:

☐ the energy savings that have resulted from steps already taken to cut energy consumption,

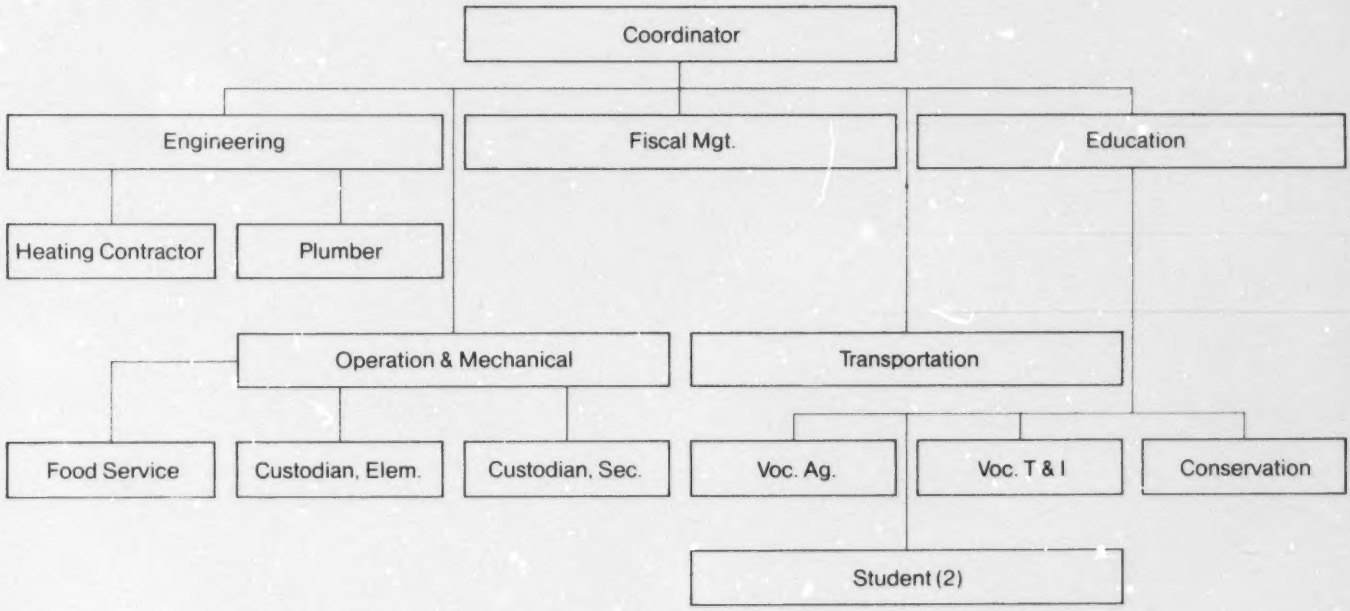
☐ the effect of anticipated rate increases on the district's energy budget if energy is used at the current rate, and

☐ the anticipated decrease in energy consumption and costs if an energy management program

Energy Team Organization Chart

Royalton School District

Independent School District #485 Energy Team



Assess Energy Status

Bagley School District In 1979 the Bagley school district contracted a local construction company to prepare an energy study for the district. The energy study was to assess the current energy use of each building in the district and to give recommendations as to how the district could save energy.

The Energy Plan proposed a Five Year Energy Conservation Plan for the Bagley school district. The Energy Plan estimated that if the recommended energy saving measures were completed during the five-year period, the district could save about 44 percent of its heating energy.

After three years, 59 percent of the recommended measures have been implemented. The district has recorded a 25 percent savings of heating energy since the energy study was initiated in 1980. This relates to approximately $58,500 in economic savings.

Goals and Objectives

Dover-Eyota School District

Total Energy Management Goals and Objectives

1. Designate an energy coordinator and establish an energy team.
2. Implement an energy accounting system.
3. Prepare district wide plan for fuel emergency.
4. Incorporate energy education into the curriculum.
5. Prepare annual energy objectives and suggest energy modifications.
6. Prepare regular reports to the school board and the community.
7. Assess results of energy management and suggest changes as needed.
8. Encourage the cooperation of employees, students and the community in a total management plan.

Although Dover-Eyota district building use has increased by 25 percent since 1976, total gas and electrical savings during the 1981-82 school year totaled $16,229.

were instituted in the district.

Determine Energy Goals and Priorities. Assess the need for updating or having new building audits done and the need for activities in the areas of accounting, curriculum, transportation, and building operations.

Based on identified needs, realistic long range and short range energy and educational goals and objectives should be developed.

Develop a District Energy Plan. Use the guidelines set forth in the school board resolution and the district energy data to design the district energy plan. The energy plan should contain specific program goals and attainable energy saving objectives for both the current year and for the future.

The energy work plan should include:

- ☐ goals and objectives,
- ☐ specific administrative rules, regulations and procedures,
- ☐ specific task assignments,
- ☐ specific timelines, and
- ☐ allowance for an annual revision of goals and objectives.

Allocate Necessary Resources to Reach Goals. Since energy related improvements can cost thousands of dollars to implement, thoughtful planning regarding use of school district dollars for these improvements is essential. School districts must analyze carefully how much each conservation measure will cost, how much fuel or electricity will be saved, and if the measure is cost effective.

In addition, staff time, materials and training funds necessary to carry out the work plan must be included in the budget. Although staff training requires release time, the more district staff know about an effective energy management program, the more support the program will have.

District Energy Management Workplan

Anoka-Hennepin School District The Anoka-Hennepin School District has an on-going commitment to energy conservation, supported by the school board, superintendent and staff. Part of the district's energy management workplan includes plans for individual buildings. Projects are based on mini- and maxi-audit recommendations. These plans are reviewed and updated annually. Implementation of workplans assisted the district in reaching an energy cost avoidance of approximately $350,000 in 1981-82.

Individual Building Energy Conservation Plan
Coon Rapids Senior High
Projects Completed 1973-74 through 1979-80
- ☐ Preventive maintenance program.
- ☐ Cut fresh air intake/meet minimum standards.
- ☐ Phase out use of reheat systems.
- ☐ Steam trap repair program.
- ☐ Lower design converter temperatures.
- ☐ Install auxiliary water heater.

Projects Completed 1980-81 through 1981-82
- ☐ Install auxiliary water heater.
- ☐ Insulation repairs (pipes, boilers, tanks).
- ☐ Install self-closing water valves.
- ☐ Install lead-lag system for boiler operation.

Projects Included in 1982-83 Budget
- ☐ Install micro-processor.
- ☐ Reduce lighting.
- ☐ Place flow restrictors on showers.

Projects for Future Consideration with Estimated Costs
- ☐ Reduce lighting levels. EST $8,000
- ☐ Change system to burn #5 oil. Est. $18,000
- ☐ Use Energy Management System for lighting.

Energy Management Timeline

Gonvick-Trail Community Schools After establishing an energy team and completing workplans, Gonvick-Trail set a timeline for energy management. The Gonvick-Trail record of energy savings is already $16, 894.

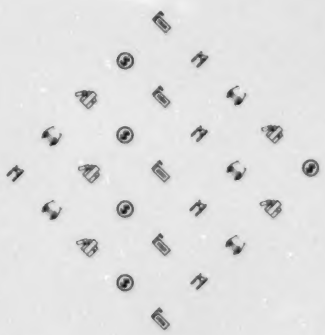
Timeline
Fiscal Year 1982:
- ☐ All repair, resurface, revamp, replace, and retrofit projects.

Fiscal Year 1983:
- ☐ Finetune and calibrate systems, experiment with solid fuels in cooperation with Northwest Economic Development, Inc. (University of Minnesota, Crookston) including briquettes, wood pellets, sunflower hulls, jojoba bean casings, marigold petals, and others.
- ☐ Continue to monitor and evaluate systems.

Fiscal Year 1984:
- ☐ Continue to monitor and evaluate systems.
- ☐ Make improvements where advisable.
- ☐ Document and quantify the energy management process and savings.

Allocate Resources for Energy Related Improvements

Luverne School District After completing energy audits to determine which conservation items would be required, the Luverne School District listed all potential conservation measures on an Energy Conservation Cost/Benefit Summary. On the basis of this summary, resources were allocated to finance improvements.



Luverne School District
Energy Conservation Cost/Benefit Summary

Specific Conservation Item	Fuel Savings MMBtu/Yr.	Net Energy Savings $/Yr.	Modification Cost $	Payback Period Yrs.
Reduce glass area	4337	14,877	216,000	11.7
Add roof insulation	1698	5,800	66,300	9.7
Replace glass block in gym	162	558	13,200	16.5
Weatherstrip exterior doors	59	200	160	0.9
Install gas water heater	126	2,500	1,500	0.7
Install timeclocks on hot water pumps	82	222	400	1.9
Reduce domestic hot water temperature	21	72	20	0.3
Install flow restrictor on showers	29	100	400	4.0
Balance and adjust air handling units	921	752	1,400	2.0
Install timers on exhaust fans	432	1,481	1,000	0.7
Reduce lighting levels in two newer gyms	*	308	300	1.1
Insulate the attic	940	3,684	11,590	3.2
Add storm windows and add'l insulation	533	2,092	76,136	over 20.0
Insulate hot water storage tank	30	77	132	1.8
Install an automatic control system	438	1,720	20,000	9.9

*15,400 KWH/Yr elect. savings

Develop an Energy Accounting System. Energy accounting is the systematic tracking and analysis of energy costs and consumption. An energy accounting system assists in better management and control of energy conservation efforts.

Through compiling historical and current energy data, a manual or computerized energy accounting system can be used to:

- ☐ track energy use and costs,
- ☐ calculate energy and dollar savings,
- ☐ identify where energy waste exists,
- ☐ provide information for budgeting, and
- ☐ justify energy management decisions.

Conduct Energy Audits of Buildings. Mini- and maxi-audits can identify cost-effective ways to cut energy use.

Energy savings that can be achieved for little or no cost can be identified through a mini-audit. This is a building inspection to assess the building's condition and energy use. Mini-audits can be used as a starting point for setting up operations and maintenance programs for increased efficiency.

A more detailed engineering analysis of a building and its energy using systems, called a maxi-audit, identifies more substantial conservation measures that would be cost effective for each particular building. Although these retrofit measures may require a significant capital investment, they would return this investment in energy savings.

Train Staff about Energy.

Providing energy related training opportunities for staff at all levels develops:

- ☐ an awareness of the significant cost of school energy use,
- ☐ an understanding of how energy is used in the school,
- ☐ the skills for reducing energy

Computerized Energy Accounting System

Monticello School District In 1980 the Monticello school district established a computerized energy accounting system. The district uses the energy accounting system to monitor the amount of energy consumed.

The energy use and costs are reviewed each month. The figures are compared on a monthly and annual basis. If energy use increases, the district immediately starts to trace the problem to determine what caused the additional energy consumption.

The following example of a monthly report shows that the Monticello district spent $31,083 in energy costs in January 1983, a reduction of $6,529 when compared to the previous January.

Energy Tabulation Sheet
January 1983 Summary
District Name: ISD #882 Monticello Schools

	School Number and Name	
	00001 Monticello Sr./Jr. High	00002 Pinewood Elementary
KWH per sq. ft.	.51	1.96
(Variation)	12%	−26%
BTU per sq. ft.	10225	6705
(Variation)	−27%	−26%
BTU per sq. ft. per HDD	8	5
(Variation)	24%	14%
TEI BTU per sq. ft.	11949	6705
(Variation)	−23%	−26%
Total Dollar Amount $	$19456	$11627
(Variation)	−$3833	−$2696
Conservation Effort $ (Variation)	$3555	$4013

Mini-Audit

Ortonville School District In 1980 the Ortonville School District had a mini-audit to identify low- and no-cost energy conservation measures. Recommendations were made and the school district has implemented each suggestion.

New Mini-Audit Opportunities	Implementation Schedule
Keep all controls free of dust.	done
Lubricate motors.	annually
Instruct personnel to turn off lights when rooms are not in use.	daily
Clean light fixtures.	annually
Set domestic water temperature to 120°F.	done
Weatherstrip all entrance doors.	done
Keep records on fuel usage and number of days standby fuel is used.	since 1955
Check systems periodically for proper operation.	daily
Check for water leaks in lavatory.	daily

Maxi-Audit

St. Charles School District The St. Charles School District used its maxi-audit as a guide for implementing energy conservation measures. These energy conserving measures saved the district approximately $10,000 in 1982-83, and this is a conservative estimate. The steps taken include:

- ☐ Vestibule doors have been added to the two north entrances in the high school building.
- ☐ The number of security lights used at the high school has been reduced by fifty percent.
- ☐ Exhaust fans in the lounge, bathrooms, and administrative area have been placed on a time clock.
- ☐ A seven day time clock controls the automatic setback controls in both the elementary and secondary buildings.
- ☐ Unit ventilators are covered during the heating season to reduce the amount of damper air leaking in from the outside.
- ☐ 45 flow control devices have been added to the district's showers.
- ☐ Light fixtures in the high school gymnasium have been replaced with metal halide fixtures.
- ☐ Fifty percent of the hallway lights in the elementary school have been removed.

Staff Training Activities

Appleton School District

1977 Energy Management Workshop at Granite Falls attended by Superintendent Kolke and Head Custodian Hullstrom.

1977 Start of emphasis on energy conservation. In-service education program for staff presented by Superintendent Kolke and Nobles Hatling of Otter Tail Power Company.

1982 Consortium of four units—Appleton School, Appleton Nursing Home, Madison School and Milan School—formed to teach energy maintenance.

use, and
☐ competency in integrating energy concepts within the curriculum.

Staff training also develops increased confidence and encourages staff to use their creativity to think of additional ways to reduce school energy costs.

Develop a Plan for Energy Curriculum. Thirty energy curriculum items are available at no charge to Minnesota's K-12 teachers. These materials, available from the Minnesota Department of Education, have energy activities for teachers to integrate within all subject areas: language arts, math, science, social studies, outdoor studies, driver's education, home economics, industrial arts, and others.

Local districts and individual teachers can assess the current status of energy education within their curriculum, identify subject areas and grade levels where energy concepts can be taught, obtain curriculum resource materials, and develop a plan to train teachers in this area.

Develop a Capital Improvements and Financing Plan.

Two thirds of Minnesota schools have completed maxi audits. Current audit results should be used to develop a capital improvements plan for improved building efficiency. Based on building audit recommendations, determine retrofit priorities, timetable, and funding strategy.

Schools now have the opportunity to raise revenue through the Special Purpose Capital Expenditure Levy Law. Proceeds from the special levy go into a district's capital expenditure fund and can be used to help pay for major energy conservation improvements.

Financing for energy audits and energy conservation measures has been available through federal grants. Schools will be notified as state or federal money becomes available in the future.

Prepare a Plan for Fuel Emer-

1982 Will Short, Appleton High School mathematics and electronics teacher, received a $200 Energy Minigrant for a project to introduce students to the usefulness and practicality of photovoltaic (solar cells) source of electricity.
1983 Staff attended Minnesota Energy Conference.
1983 Campaign started to conserve recyclable materials and sell them. Energy conserved through recycled paper production.
1978-83 Emphasis on energy conservation through memorandum to staff. Staff encouraged to control room temperatures, close classroom drapes, turn out lights, etc.

The Appleton School District has also completed numerous energy saving measures, saving about $15,700 in annual fuel costs.

Energy Curriculum Planning

Elk River School District To encourage and coordinate an effective and comprehensive energy education for students in the Elk River School District, the following curriculum goals were established:
☐ To determine what energy education is currently provided in District #728 schools.
☐ To prepare a District #728 philosophy statement to guide development of energy education.
☐ To develop an energy education curriculum guide that cross references energy objectives and activities to existing curricula.

The goals were accomplished through identifying and implementing the following objectives:
☐ To collect information from all District #728 schools regarding what energy education is currently provided.
☐ To designate a teacher at elementary, junior high, and senior high levels as an energy education resource person available to other teachers.
☐ To cross reference energy education objectives and activities with the existing curricula in science, social studies and health.
☐ To plan for in-service training for teachers regarding energy education materials available.

Training for Building Operators

Brooten School District The Brooten School District recognized the importance of training building operators. Through training for energy efficiency, building operators are able to implement mini-audit recommendations and learn to run all equipment as efficiently as possible.

The Brooten district sent their building operator, Sidney Sagedahl, to the following training sessions:
Energy Efficiency Workshop
Mini-Audit Certification Workshop
Boiler Maintenance and Operation Workshop

Building managers and operators can attend these and numerous other energy related workshops at a low cost. Some of the other topics are steam traps, pneumatic temperature controls, preventive maintenance, insulation, lighting, and energy accounting. The training sessions are held at area vocational technical institutes throughout the state each year.

Capital Improvements Finance Plan

Upsala School District The Upsala school district was aware that the condition of the school building was not energy efficient. Determining solutions to the problem areas led to the question of how to finance the improvements. The district devised a plan to apply for federal funding to subsidize costs of capital improvements.

Upsala Public School

Condition	Solution	Total Cost	Owner	Federal
Insufficient insulation in roof areas.	Add insulation to provide R=20.	$43,000	$33,000	$10,000
Warm air stratifies in upper area of gym.	Install stratification fans.	$2,200	$ 1,100	$ 1,100
Double glazed west elevation.	Install insulated wall panels.	$11,402	$ 5,701	$ 5,701
Existing incandescent lights are inefficient light source in gyms.	Install fluorescent lights in elementary gym.	$ 2,400	$ 1,200	$ 1,200
	Install sodium lights in secondary gym.	$ 6,600	$ 3,300	$ 3,300

Fuel Emergency Plan

Roseville School District In response to rising fuel prices in recent years, the Roseville School District has implemented numerous energy conservation measures to cut energy use. The district reduced energy use for heating by almost 7 percent from the 1981-82 school year. However, if a fuel shortage were to develop in the future, the district is prepared to take measures specified in its fuel emergency plan.

gency. Develop a brief plan for reducing transportation consumption in the event that a fuel emergency is declared. Guidelines for fuel emergency plans are available in the *Minnesota Schools Workbook for Developing an Emergency Transportation Program* by the Minnesota Department of Energy and Economic Development.

Recommended Action During Emergency

1. General Alternatives
   a. Close on Mondays
   b. Close for a full week in February.
   c. Close on five days of severe weather.
2. Heat at a 62°F to 65°F range in occupied classrooms, offices, gymnasium, etc.
3. Off-Hours
   a. Daily heat closed off at end of school day and allowed to drop to 55°F.
   b. Weekends and other days when classes are not in session:
   - ☐ heat set at 55°F,
   - ☐ water heaters set at minimum temperatures,
   - ☐ swimming pool and deck temperatures to be lowered 3°F,
   - ☐ all school and non-school users will be encouraged to cancel or reschedule activities,
   - ☐ no new activities to be scheduled for duration of emergency
4. Under the signature of the Board Chairman and Superintendent, send a letter to all residents in the district urging that further conservation measures be taken in homes.

Implementation

Incorporate Energy Education into the Curriculum.

Classroom energy education can supplement a school wide energy program and inform students about the school energy program.

Energy concepts are relatively easy for teachers to infuse into their curriculum because they are current, interdisciplinary and can be taught in all grade levels. Minnesota specific curriculum resources are available to help students understand how energy issues affect their state, community and families.

In addition, the school building can be a valuable energy education resource. Students can use their school building as a lab by monitoring its energy use and experimenting with ways to reduce energy consumption.

Incorporate Energy Efficient

Energy Curriculum

Hallock School Districts Energy concepts are incorporated into the curriculum at all grade levels in the Hallock School District.

In the elementary level classes, energy topics include:

- ☐ Effects of light and heat energy from the sun,
- ☐ What students can do to save energy,
- ☐ Fuels used for heating,
- ☐ Use of insulation, and
- ☐ Alternative forms of energy, such as wind and solar.

In the secondary level classes, energy topics include:

- ☐ Physical measurement of energy,
- ☐ Nuclear relationships,
- ☐ Energy as related to cell respiration and metabolism,
- ☐ Automobile efficiency through basic maintenance,
- ☐ Design of electrical circuits to limit circuit overloading, provide convenience, and also maintain efficiency, and
- ☐ Energy management in farming operations.

Student Involvement in Energy Studies

St. Charles School District Each winter Terry Knothe's physics students at St. Charles High School complete an extensive unit on home energy consumption. The purpose of the unit is to help each student understand how his/her home is heated, where the heat goes, the cost of heat loss, and what to do about it.

Students are asked to collect data for a heat loss program available through the Minnesota Educational Computing Consortium. The computer tells students which part of their house loses or conserves energy and helps them and their parents decide what should be replaced, insulated or repaired.

The computer printout shows how and where energy is lost in the home, including specific dollar amounts. It also gives projected savings from making recommended repairs or changes. Students use this information, along with information supplied by the instructor from consumer reports, newsletter articles and Northern States Power materials, to complete the unit by writing a paper about their findings concerning their home's efficiency.

The unit gives the students an awareness of their homes' energy consumption and ways to reduce this consumption, as well as an everyday application of physics and computer science principles.

Community Energy Education

Duluth School District The Energy Educators Group in the Duluth School District coordinates energy education activities. To fulfill the district's role in community energy education, this group created an Energy Resource Center in the Duluth Public Library.

The Energy Resource Center is a cooperative effort of several agencies, administered by the Duluth School District's adult vocational education branch. The Energy Resource Center serves as:

Operations and Maintenance Practices. Up to a 15 percent reduction in energy use in schools is possible for little or no capital cost. Changes in operating and maintenance procedures save energy through more efficient use of a building and its systems.

Implement an Energy Accounting System. Adopt or develop a manual or computerized accounting system to track energy use and costs on an on-going basis. Use energy accounting to provide monthly and annual energy use and cost reports for each building.

Carry Out Major Retrofit Projects. Based on maxi-audit recommendations, energy efficiency improvements can be made in the building envelope and its energy using systems. Such improvements may include changes in the building shell itself and substantial modification of mechanical equipment, lighting, and heating, ventilation, and air conditioning systems.

Make Changes in Routing and Vehicle Maintenance that Could Cut Energy Use.

School districts that have implemented comprehensive fuel economy programs have been able to reduce the amount of fuel their school buses consume by over 25 percent.

School business officials, drivers and mechanics together can cut school energy costs for transportation. Fuel costs can be controlled through well planned routing and scheduling, regular vehicle maintenance for maximum efficiency, and fuel efficient driving habits.

Thorough records of the miles per gallon achieved by individual buses and drivers are essential. Careful accounting of energy use demonstrates the effectiveness of efficient driving habits and savings potential of buses with fuel economy features.

☐ a resource to teachers looking for class projects and curriculum materials,
☐ a resource to students doing research on energy topics,
☐ a resource to the public for literature on energy topics,
☐ an organizer of energy materials,
☐ a coordinator of community energy education conferences,
☐ a promoter of energy conservation, and
☐ a press liaison regarding energy questions.

Low and No Cost Conservation Measures

Staples School District A mini-audit was conducted in May 1979 to identify low- and no-cost energy saving measures. Upon mini-audit recommendations, the following improvements were made in Staples school buildings:

☐ Weatherstrip doors and windows.
☐ Lower room temperatures during occupied periods.
☐ Reduce room temperatures through use of night set-back controls.
☐ Turn off ventilation system during unoccupied periods.
☐ Reduce the temperature of domestic hot water.
☐ Remove lights in overlit areas.
☐ Replace existing lamps with high efficiency lamps.

On-going Maintenance Plan

St. Paul School District Building operations personnel in the St Paul School District are instructed on what procedures must be performed as part of the on-going maintenance plan. They are also instructed on the reasons, both general and specific, of why they are performing the required tasks. Duties include:

☐ Cleaning boilers at specified intervals.
☐ Keeping accurate fuel consumption records and oil samples for testing.
☐ Changing fan filters.
☐ Greasing fans.
☐ Greasing and adding oil to all mechanical equipment on a scheduled basis.
☐ Checking equipment operation daily.
☐ Draining air compressors weekly.
☐ Changing modes of the control system at the building central panel.
☐ Checking exhaust fans for proper operation.
☐ Checking area temperatures.
☐ Closing drapes and shades at the end of the school day.
☐ Reporting any performance deficiencies to the responsible departments.
☐ Checking time clocks periodically and always reset after any power failure.

Cooperation of the educational staff is also necessary in the energy conservation effort. Ongoing maintenance duties of the educational staff include:

☐ Shutting doors at the end of the school day.
☐ Closing drapes or pulling shades after school.
☐ Using locally controlled exhaust fans only for what they were designed.
☐ Not opening the windows during the heating season.
☐ Shut off lights when leaving rooms.
☐ Report overheating to building engineers.
☐ Not changing the thermostat settings.

Implement Energy Accounting System

Pillager School District The Pillager district established a computerized monthly recordkeeping system for fuel oil and electrical consumption in 1982.

Energy consumption reports are then sent to the head custodian for review. Comparisons are drawn with consumption in previous years and weather adjustments are made.

Through regular review of these reports, Pillager can spot potential problems in the electrical and heating systems immediately.

In addition, the energy consumption records can be used to estimate the fuel savings resulting from energy conservation measures.

Major Retrofit Projects

Montevideo School District The Montevideo School district completed numerous major energy conservation measures including:

Conservation Measure	Cost	Annual Energy Savings
Add 12" ceiling insulation	$30,835	$1,385
Install storm windows	15,400	1,432
Replace 17 doors with insulated doors	5,950	330
Add 2" wall insulation	30,700	2,905
Install insulated panels	40,680	4,355
Replace main entry doors	7,000	360
Install boiler draft and electronic controls	7,500	6,270
Change to fluorescent lighting	14,460	2,288

Major Retrofit Project

Swanville School District In response to rising fuel oil prices, the Swanville School District converted its boiler from fuel oil to wood burning in 1982.

After the conversion, heating bills dropped from $36,000 to $25,000, resulting in annual savings of $11,000.

At this rate of savings, the district estimates the new wood burning boiler system will pay for itself in less than nine years. The boiler cost $90,000 to install.

The wood burning boiler in the Swanville School District has another important benefit. Since the system burns wood pellets that are produced in Minnesota, the school district helps stimulate the local economy.

Capital Improvements

St. Martins Lutheran School St. Martins is a private school and the building is used not only for school purposes, but also for church services and related church activities.

Energy efficient improvements are done through a cooperative effort among the Ways and Means Committee, the Property Board, and members of St. Martins. All projects were completed without the use of federal monies.

Some of the energy related capital improvements completed are:

☐ Remove and replace all windows with efficient windows and add insulation to fill-in areas.
☐ Acid clean main boiler for improved efficiency.
☐ Replace all 96 flues in main boiler for preventive maintenance.
☐ Replace all thermostatic steam traps.
☐ Maintenance agreement with control company to provide good repair of pneumatic temperature control system.

Through these improvements, St. Martins Lutheran School has cut natural gas use by about 38 percent in 1983, compared to 1982.

Transportation Planning

New York Mills School District One goal set by the New York Mills School District for 1982-83 was to reduce transportation energy consumption by eight percent from the previous year.

This goal was met through the following strategies:

☐ Develop and implement an energy accounting system for transportation.
☐ Eliminate one bus route.
☐ Convert two buses to propane and monitor operations.
☐ Provide in-service training for bus drivers on driving techniques to conserve fuel.

The resulting monthly transportation report has been used by the district to:

☐ Determine the efficiency of each vehicle.
☐ Monitor possible energy related mechanical problems.
☐ Compare conservation efforts of bus drivers.
☐ Provide feedback to drivers on conservation efforts.
☐ Review transportation fuel costs by month.

School Bus Fuel Consumption

McGregor School District School buses in the McGregor district provide transportation for 730 students in an area encompassing about 900 square miles. In fact, the combined annual mileage of McGregor school buses is enough to circle the globe eight times!

Since money spent for transportation represents a large portion of the district's budget, the decision was made to convert eleven buses to a dual-fuel system in an effort to reduce fuel costs. The buses now run on either gasoline or liquid propane, depending on the distance to be traveled.

Combined with a regular vehicle maintenance program, the school bus conversions have saved the McGregor district an estimated $12,000 annually.

Evaluation

Assess Results of Energy Management. An energy accounting system will measure reductions in energy use. Although energy bills probably will not be any smaller due to energy price increases, an energy management program can help schools estimate the energy costs that were avoided through conservation.

Furthermore, the energy team should determine whether the goals they established were met.

Modify Energy Plan. Total Energy Management is an on going process. After initial major goals are met, school energy savings must be maintained and new areas for savings identified.

Recognize Accomplishments. When recognition or an incentive is offered as a reward for a good job, it is human nature to do more work with a better attitude. Recognition can be given to superintendents, teachers, students and custodians in a variety of ways: cash, buttons, awards, publicity, etc.

In addition to providing recognition to energy savers within the district, communicate the successes of your district energy program to the community. Not only will your district receive recognition for past efforts in energy conservation, but, equally important, other schools will be challenged to save even more energy.

Record of Savings

Hopkins School District An Energy Conservation Report is prepared annually for district administrators in the Hopkins School District. Summary data is compiled from reports showing energy use and cost by building.

Energy Conservation Report
Summary Data

Budget Year	Annual Savings	Cumulative Savings
1977-78	$ 15,000	$ 15,000
1978-79	40,000	55,000
1979-80	32,000	87,000
1980-81	54,000	141,000
1981-82	182,000	323,000

The record shows:

- ☐ Energy use has been reduced.
- ☐ Increase in energy budget is less than rate increases.
- ☐ Reduced use of energy means less district resources diverted from educational programs.

Student Community Interaction Project

Alexandria School District Together with the Alexandria Chamber of Commerce, the Alexandria School District sponsored an Energy Awareness Week to educate students and the public about the various forms and benefits of energy conservation.

The Alexandria Energy Awareness Week was rated "best in the nation" by the Director of the National Energy Education Day program. Alexandria earned this honor primarily for three reasons:

1. Involvement of both schools and the community in energy conservation education.
2. Extensive planning by local organizers prior to energy week activities.
3. Plans to continue efforts in energy conservation.

A variety of Energy Awareness Week activities were planned, involving students and communities. Some of the activities were:

- ☐ speakers on energy issues,
- ☐ public tours of alternative energy uses,
- ☐ energy fair with 41 displays,
- ☐ poster and speech contests,
- ☐ student commercials on radio and television,
- ☐ radio programs,
- ☐ teaching units on energy, and
- ☐ energy conservation checklists distributed.

Energy Saver Recognition

Mankato School District The Mankato Citizens' Energy Advisory Committee publishes a District Energy Newsletter. In each newsletter, an article recognizes a person or persons within the Mankato School District who have implemented outstanding energy conservation methods within their department.

Energy savers honored in the newsletter include:

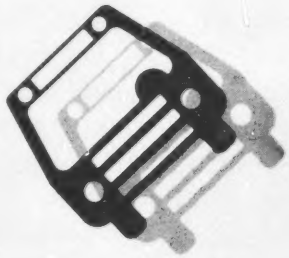
- ☐ food service personnel at East High School for reducing electrical demand,
- ☐ district maintenance personnel for numerous efforts in reducing energy consumption,
- ☐ principal, staff and students at Kennedy High School for reducing electrical consumption 27 percent,
- ☐ head building engineer at West High School for calibrating and adjusting thermostats,
- ☐ head custodian for outstanding work and leadership in energy conservation, and
- ☐ science teacher for work on City of Mankato Environmental and Energy Awareness Committees.

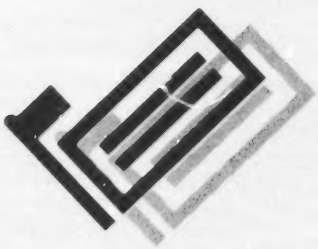
Resources.

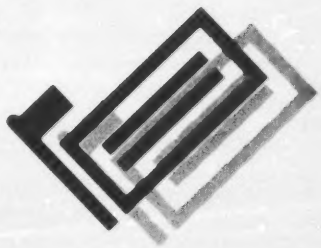
Resources and assistance in developing a Total Energy Management program are available from the Minnesota Department of Education, local Educational Cooperative Service Units (ECSU's), Northern States Power and other utilities, and professional education associations.

For more information on these resources and assistance, contact Jackie Lind, Manager, Educational Technical Program, (612) 296-7502 at the Energy Division of the Minnesota Department of Energy and Economic Development.

The Total Energy Management program is endorsed by the Minnesota School Boards Association, the Minnesota Association of School Administrators, the Minnesota Association for Pupil Transportation, the Minnesota Catholic Conference, the Minnesota Association of School Business Officials, the Minnesota Association of School Maintenance Supervisors, the Minnesota Association of Secondary School Principals, the Minnesota Elementary School Principals Association, the Minnesota Department of Education, the Educational Cooperative Service Units (ECSU's), Northern States Power, and Minnegasco.







Energy Division
Minnesota Department of
Energy and Economic Development
980 American Center Building
150 East Kellogg Boulevard
St. Paul, Minnesota 55101